



Beyond Swipes and Scores: Investigating Practices, Challenges and User-Centered Values in Online Dating Algorithms

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The reliability of online dating algorithms has sparked considerable debate, particularly regarding skepticism about their excessive emphasis on evaluating and getting evaluated, which often overshadows the quest for authentic romantic connections. To understand the multifaceted influence of dating algorithms on end-users and explore avenues for algorithmic features considering the dynamics of human relationships, we conducted a mixed-methods study comprising in-depth interviews ($N = 22$) and a metaphoric co-design workshop ($N = 12$) with active users of online dating platforms. Interviews revealed that users perceive and respond to algorithmic evaluations with varied perceptions and behaviors, often expressing concerns about the emotional burden of constant self-presentation and the pursuit of quantitative assessments over genuine connections. In the design workshop, users envisioned desired algorithmic features to overcome investigated challenges, such as prioritizing personal values, tailored matchmaking, and support for personal growth in relationships. This research contributes to unraveling the complex dynamics of human-algorithm interaction in the context of online dating. By aligning algorithmic functions more closely with user desires and relationship goals, this study paves the way for more meaningful and authentic connections in the digital dating landscape.

CCS Concepts: • **Human-centered computing → Empirical studies in collaborative and social computing.**

Additional Key Words and Phrases: Online dating, Dating application, Algorithmic platform, Folk theories, Participatory design, Romantic relationship, Matchmaking

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1 INTRODUCTION

Humans have always searched for the possibility of finding love through diverse mediums, from human matchmakers such as family, friends, and colleagues, to digital devices such as a phone line, advertisements [1], and most recently, online dating applications. Today, recommendation algorithms in dating applications are the matchmakers shaping romantic and sexual relationships

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for many people. With the majority of new couples in the U.S. meeting online [9, 82], there is no doubt that we have now entered a new era of dating.

The primary motive for users of online dating platforms is to forge romantic relationships, an endeavor predicated on the assumption that algorithms can predict love and recommend suitable partners. For instance, Tinder¹ was once known to utilize Elo scores [10] for matchmaking, a system used in the chess game, where ratings are based on wins and loses against players of varying skill levels [98], while Hinge² employs the Gale-Shapley algorithm [70] which aims to create stable matches based on mutual preferences [99]. However, existing research presents a skeptical view of the efficacy of these algorithms in fostering genuine romantic connections. Researchers have demonstrated that while algorithms might indicate selectivity and desirability, they falter in predicting the elusive chemistry between individuals [31, 86]. Moreover, there is scant evidence supporting the ability of scientific algorithms to accurately forecast compatibility or chemistry between potential partners [31].

The perspective of online dating application users (a.k.a. online daters) on online dating algorithms builds upon to the current concerns on algorithmic matchmaking systems. The ‘black box’ nature of these algorithms often obscures the users’ understanding of how the algorithms function [69], which leads them to form beliefs about their operational mechanisms and interact accordingly [48, 51, 52], which is so-called algorithmic folk theories [17]. Studies on the algorithmic folk theories for online dating have revealed that users often believe the algorithms rate their attractiveness and suggest matches with similar scores [48, 71]. Moreover, previous studies covering a wide range of user interaction with online dating services also highlight how users focus on self-presentation strategies, emphasizing physical appearance and basic demographics, and commodify themselves within the services [25, 42, 79, 96].



Fig. 1. The profile UI of five active dating applications in South Korea: Tinder, Bumble³, Eharmony⁴, Whippy⁵, and Amanda⁶.

Although the concept of algorithmic folk theories and their impact on user strategies have been extensively explored in various contexts [51, 52, 92], there remains an acknowledged gap

¹<https://tinder.com/>

²<https://hinge.co/>

³<https://bumble.com/>

⁴<https://www.eharmony.com/>

⁵<https://www.wippy.io/>

⁶<http://amanda.co.kr/>

in understanding how these theories apply to the specific context of online dating. This gap is particularly relevant given the intricate nature of human relationships, which involve complex factors such as emotions, biases, and personalities [65, 68]. Such considerations highlight deficiencies in the design of current algorithmic features within dating applications [59, 79]. To address this gap, our study shifts focus to the perspectives of users, who are uniquely positioned to identify the limitations of these systems in fostering authentic human connections. Thus, we conducted a mixed-methods study to first understand the algorithmic impact and challenges that users experience in using online dating applications and algorithms, then co-design algorithmic features to address the aforementioned challenges in designing user-desiring online dating services considering the dynamics of human relationships. We conducted semi-structured interviews and participatory design workshops in the context of online dating applications that are popular in South Korea (Fig. 1). Tinder, the most widely used online dating application worldwide [32], remains the most popular online dating application in South Korea nearly doubling the number of users of the second most popular dating application ‘Glam’ [12].

In Study 1 ($N = 22$), an interview study was conducted to determine how online daters perceive the evaluation of these algorithms and how they interact with them. We then extracted exemplar challenges based on user experiences associated with algorithmic attributes. Our analysis reveals that participants’ perceptions and behaviors are influenced by their understanding of being scored by online dating system algorithms. We observe that participants frequently express concerns about the algorithmic nature of online dating, highlighting issues such as the emotional toll of constant self-presentation and the challenges in navigating a system focused more on quantitative assessments than genuine human connections. Moreover, they engage with the system to meet distinct personal objectives, like devising methods to attain higher scores, which diverges significantly from the service’s main goal of finding a suitable partner. This includes behaviors such as users acting as if they themselves are the algorithms, leveraging the algorithm to unearth self-values, and adopting extreme self-presentation strategies to gain higher attractiveness scores.

In Study 2 ($N = 15$), to discern the algorithmic features desired by the online daters facing the challenges mentioned above, we conducted a comprehensive design workshop employing metaphoric design techniques, thereby contributing to the development of future online dating algorithms that better facilitate human relationship formation. As a means of helping online daters envision desired algorithmic features, we provided carefully designed workshop material that uses everyday objects as metaphors for working algorithms. In five co-design sessions ($N = 15$), participants initially emphasized key challenges within current online dating algorithms and articulated a broad set of design objectives aimed at improving the online dating experience: (1) cultivating an environment that encourages the sharing of genuine personal values, (2) refining matchmaking features to be more responsive to each potential dating partner’s unique characteristics, and (3) supporting personal development within the context of romantic relationships through algorithmic guidance. In pursuit of these goals, participants proposed detailed design concepts, such as navigating the varied values and situations unique to each individual, implementing matchmaking styles that adapt to the specific preferences and needs of potential partners, and enhancing the overall online dating journey—from crafting compelling profiles to fostering authentic, meaningful connections.

We further discuss the complexity of folk theories specific to online dating algorithms, alongside the potential for risky behaviors and attitudes that may arise from the evaluative mechanisms inherent in online dating applications. Our metaphoric co-design workshop, which enabled participants to tangibly articulate their envisioned solutions, has led us to propose broader implications for designing online dating applications that can foster more genuine human connections. These

include the development of adaptive, personalized matchmaking systems and the seamless integration of real-life dating strategies into the digital dating arena. We offer three contributions in the context of online dating algorithms:

- Empirical findings of perceptual and behavioral effects of algorithmic evaluations on users
- Metaphoric co-design approaches for designing algorithmic features in online dating services
- Design implications for authentic connection facilitation in online dating services

2 RELATED WORKS

2.1 The Impact of Algorithmic beliefs on User Emotions and Behaviors

Online sociotechnical systems such as Tiktok, Airbnb, and Tinder are becoming increasingly reliant on software algorithms to manage user preference information to recommend contents and services for them [80]. Due to the opaque nature of the algorithms, users form their own hypotheses about the functioning of these systems to make sense of their interactions and experiences [35, 54]. Today, a number of HCI researchers are exploring user beliefs formed toward the invisible algorithm, emotions they evoke, and how they effect user experiences with the system.

A number of recent research have investigated on the influence of algorithmically-driven content curation systems on user emotions and relational behaviors. In an analysis of folk theories formed about the algorithm for the ForYouPage in TikTok, researchers revealed that users believe the algorithm tailoring content to their personal identities which made them concerned on how the feed may amplify biased perceptions or suppress certain social identities. This induced emotions of frustration, anger, and a sense of being marginalized or silenced among the users which led them to take actions to resist and prevent such influences on their identity [52]. Another research on Airbnb—an online housing recommendation platform—found that the housing hosts believe they have direct control but perceived some uncertainty over the factors that they believe affect their evaluation by algorithms. This belief induced algorithmic anxiety for the hosts toward appealing to their potential guests and the algorithm and therefore developed strategies to cope with their anxiety [51]. In a study of understanding young people's everyday interactions with algorithms and their effect on algorithmic literacy, Swart et al. looked into their experiences of personalized news on social media platforms. They discovered that the young people were wary of the algorithmically curated news because they feared missing out, and were concerned about surveillance. To deal with these emotions, they either chose to be satisfied with the system, tried to negotiate algorithms' decisions by adjusting personal settings, or add additional sources to their news repertoires [92]. These studies disclose a rich understanding of how users form beliefs about the opaque algorithms, highlighting the potential for emotions of anxiety or frustration, and discussing the perceptions or behaviors triggered by those emotions.

In the case of online dating, prior research reveals that users believe the algorithm evaluates its users depending on their attractiveness, assigns them to specific brackets based on their scores, and displays their profiles to other users who are within the same bracket [48]. Under this theory, users assume that their scores change as other users like or dislike their profiles [48, 71]. However, despite the nature of online dating which prioritizes relationship formation and emotional investment [81], these studies limit their work to defining the algorithmic folk theories and user strategies they use to leverage the algorithm system, leaving behind the motivations for their actions.

In our study, we expand upon existing literature on algorithmic beliefs related to online dating services to investigate the effect of the belief on the evaluative features of online dating algorithms on shaping user experiences, and further identify the user challenges from those experiences.

2.2 The Dynamics of Romantic Relationships and Various Online Dating Strategies

It has been known to that the strongest motivation for using online dating applications is to seek love and romantic relationships with others [6, 27, 40]. Due to this motivation, online daters make effort to appeal to others using various self-presentation strategies. Most research regarding users' evaluation and self-presentation strategies in online dating services focus on the physical attractiveness of users. The attractiveness depicted in online profile pictures significantly influence user interactions, with more attractive images drawing increased messages [26, 39, 94]. Consequently, users frequently manipulate their images by using strategies including exaggerated photos, selection of photos taken by friends, and even asking online dating coaches for feedback [97, 103]. Not only do online daters focus on visual appearance, but studies also reveal how many online daters mildly exaggerate answers for the demographic data of their profiles in fields such as age, height, and income [26, 36, 94].

While there is a wealth of study on the strategies focusing on physical attractiveness of users, there is a noticeable lack of studies done on the user strategies to appeal of personality traits for self-presentations in the realm of online dating. This is surprisingly different from dating strategies used in real-life dating, as many studies reveal how personality traits, non-verbal cues(e.g. eye-contact), or communication styles play a crucial role to appeal their potential partners [30, 59, 63, 85].

However, previous research has cast doubt on the effectiveness of online dating algorithms in establishing meaningful romantic connections. These studies highlight concerns on the algorithms' limited capability in predicting the elusive, intangible chemistry that often sparks between individuals [31, 86], or their inadequacy in capturing essential but less tangible aspects of compatibility, such as personality traits, which are crucial for forecasting the potential for long-term relationships [87]. Moreover, HCI studies have pointed to potential biases inherent in algorithmic matchmaking on dating websites, where these algorithms prioritize physical attractiveness and race [49, 66, 72]. These not only narrow down the recommended user pool but also can amplify user behaviors that reflect pre-existing biases towards certain characteristics in potential partners. Studies have demonstrated that such algorithm-driven biases can lead to discrimination and limit the diversity of matchmaking outcomes in the long-term, reinforcing the necessity for designing more inclusive online dating environments [49, 66].

Leveraging existing literature on online dating strategies of users and the nature of human romantic relationships, it becomes clear that the current online dating experiences do not sufficiently fulfill the desires of mutual relationships and romantic chemistry between individuals. In this study, we aim to address this gap by further identifying the algorithmic features fulfilling the desires online daters hold for forming romantic relationships in online dating platforms.

2.3 Participatory Design and Metaphoric Design Approaches

HCI researchers have advocate for user-centered methodologies to enhance user experiences in the context of platform algorithms. In particular, the participatory design(PD) and co-design methods are extensively employed to understand users' perspectives [104]. Design workshops can be used to engage users to design frameworks for HCI, develop and test interventions, and even design algorithmic features [33, 58, 93]. A large body of work has been done to explore the possible algorithmic features in various contexts by inviting participants to the design context, to examine their specific needs and suggestions on the platforms design [22, 100]. For example, Zhang et al. invited participants to design algorithmic features that would support well-being for ride-share drivers by providing prompts and intervention types [102]. Lee et al. invited participants to build algorithmic policies and construct a computational model:WeBuild AI [58]. Choi et al. invited

Youtube creators to design creator-friendly algorithmic platforms by providing intervention types for solution ideas [11].

However, these PD methods inviting users to design algorithmic features has not been applied in the online dating services. In our work, we investigate the algorithmic features desired by online daters through a PD workshop, using a metaphoric design approach. The aim of most algorithmic platforms are concentrated to personal entertainment, socializing with people online, or financial profit [46], thereby prioritizing values such as efficiency, accuracy, scalability, and robustness [15, 20]. However, the aim of online daters are rather different as their goals focus on fulfilling romantic desires and building relationships with potential dating partners through emotional exchange. Rather than efficiency or robustness, emotional exchange and human chemistry becomes the prior values in this domain [2]. For this reason, online dating services can benefit from design solutions that are unique from other conventional algorithmic platforms.

Moreover, leveraging the characteristics of the online dating context, we use a metaphoric design approach to facilitate design thinking. By using metaphors, participants are invited to think beyond the conventional boundaries of algorithmic logic [62, 84], exploring how romantic interactions and connections can be fostered in a digital environment. This can lead to the development of innovative features that resonate on a more emotional and human level, aligning with the primary goals of online daters. Additionally, metaphors can serve as a bridge between the technical aspects of algorithm design and the human experiences they aim to enhance [84]. They can demystify complex algorithmic processes, making them more accessible and relatable to users. This accessibility is crucial in participatory design workshops, as it empowers users, who might not have a technical background, to actively contribute to the design process.

3 STUDY 1: SEMI-STRUCTURED INTERVIEWS

Study 1 aimed to analyze the user experience with the recommendation algorithm inherent in online dating applications, which is the whole process which comes before users having conversations or meet-ups with their matched partners. We conducted a semi-structured interview with users who have prior experience in online dating applications to get in top personal online dating experiences, and the perceptions and behaviors related to those experiences. In what follows, we introduce the recruitment process, participant dynamics, interview protocol, and results of the data analysis.

3.1 Recruitment

We tried to recruit participants who meet two criteria: a user who (1) have in-depth engagement of at least one dating application for at least one month, and (2) is interested in sharing their personal dating experience. Recruitment flyers were posted at online university boards and student communities in South Korea. Within recruitment flyers, we asked potential participants to complete an online survey form to screen the right population for our interviews.

3.2 Participants

In total, 54 South Korean users responded to the our screening survey (28 male and 26 female, aged 19-33 ($M = 24.66$, $SD = 2.99$)). The survey began with asking the demographic data of participants, followed by general questions about online dating application usage. Participants answered to have used an average number of 3.13 different dating applications, mostly Tinder (63.0%), followed by Amanda (42.6%) and Glam ⁷ (35.2%). Among these survey respondents, we finally selected 22 interview participants by going through screening process. As a result, we were able to conduct

⁷<https://www.glam.am/>

Participant	Age	Gender	Usage Period	Number of Application Used
P1	25	M	6months~1year	4
P2	24	M	~1month	3
P3	27	F	1year~3years	2
P4	26	F	1year~3years	4
P5	20	F	1year~3years	5
P6	20	F	6months~1year	2
P7	25	M	1year~3years	4
P8	27	F	3years~	4
P9	24	M	1year~3years	8
P10	26	M	6months~1year	9
P11	26	M	~1month	8
P12	29	M	1year~3years	4
P13	29	M	1month~6months	4
P14	24	M	6months~1year	3
P15	29	M	6months~1year	1
P16	27	F	~1month	1
P17	33	F	1month~6months	2
P18	22	F	1month~6months	2
P19	23	M	3years~	10
P20	25	F	1month~6months	3
P21	22	F	6months~1year	4
P22	25	F	1year~3years	4

Table 1. Demographics of interview participants.

online interviews with 22 participants involving 11 male and 11 female aged 20-33 ($M = 25.36$, $SD = 3.08$).

3.3 Interview Protocol

The interview began with general questions about their online dating experience, their motivations for using these services, and how their satisfaction has changed as they continuously use them. Then, we encouraged participants to share their personal experiences related to their algorithm experiences focused on their feelings while interacting with the algorithm-mediated online dating services. Additionally, we asked questions about their perceptions of the algorithm of services and how those perceptions affect their interaction within the platform. We conducted all our interviews were conducted remotely via zoom without video streaming, and each interview session lasted between 40-90 minutes. All interviews were conducted in Korean and audio-recorded upon their permission. Participants were compensated with 20, 000 KRW (Approx. 15 USD). Our study protocol was reviewed and approved by the IRB committee of the author's university.

3.4 Data Analysis

We used ATLAS.ti to transcribe the recorded audio and analyze the quotes. Three of the authors open-coded 20% of the material and conducted a discussion to establish an initial theme. The remaining data was distributed to the coders. We highlighted quotes about algorithmic experience and challenges users face with online dating applications, and categorized the initial themes.

Another researcher read and gave feedback on the categorized themes and quotes. Based on this, the three researchers iteratively modified themes until the topic is distinctly categorized.

4 STUDY 1 RESULT: ALGORITHMIC IMPACTS ON ONLINE DATING EXPERIENCE

Our analysis shows that participants' diverse perceptions and behaviors are affected by the belief that the algorithm of online dating systems evaluates the attractiveness of online daters. Further, they utilized the system for their own individual needs, which were far from the primary purpose of the services: finding a suitable partner.

4.1 Acting as though the users themselves have become the algorithm

Overall, we found that many participants felt a 'guilty pleasure' while interacting with online dating services. They were having fun endlessly browsing the profiles of others and scoring them but also felt guilty when they had to give dislikes or low scores. P9 explained this experience: "*It's something like guilt, but its kind of coexisted with feeling a bit sorry. So, it's like feeling fun and sorry while evaluating other users.*" On the other hand, some participants explained how the whole evaluation process is boring and ineffective. They explained how exhausting the endless evaluation process is, especially due to the opaque nature of the matchmaking algorithms. P8 explained: "*I got a dating app hoping to find something real, you know? But from the get-go, they're like, 'rate this person, rate that person', and I don't even know how they use these ratings for matching. Eventually, it just got so tiresome, and I found myself rating people without really meaning it.*". While many participants noticed how they spent most of their time evaluating other online daters, they revealed an inconvenience in how they felt that the algorithm was not understanding their evaluations, resulting in dissatisfying recommendations. P16 explained "*To be honest, I think there isn't such thing as an algorithm. The faces and height of the recommended users are all so different, so I felt it as just random recommendations*".

We found participants adopted an algorithmic perspective in time, using the online dating applications with the core purpose of evaluations. Our participants often described that they viewed 'rating' as a right given to them, explaining that they themselves acted like a filtering algorithm, evaluating and screening others based on their own criteria. They found themselves mechanically swiping other online daters to manipulate their recommended user pool. Three participants manipulated the user pool by filtering out individuals they defined as unattractive based on their own standards. P18 explained her strategies to manage the user pool of the applications based on her beauty standards "*I gave low scores because I thought 'these people shouldn't be using this app' ... I thought unattractive people would harm the user pool ... yes I was trying to filter the user pool myself.*". Furthermore, we found that some users brought these standards made for swiping online into real-life. They explained how they objectified people they meet, and treat them accordingly. For example, P22 described her personal experience: "*I started to objectify people I meet, based on my standards I used online: is he a safe person who would not threaten me, and is he a person I can have sex with.*".

4.2 Leveraging the algorithm to discover values of the self

Although participants were aware of the subjectivity of evaluations from other online daters, they still believed that the attractiveness scores given by the algorithm that leverages collective intelligence was somewhat objective and absolute. Building on this belief, we found that many participants reflected a strong desire of wanting to know their attractiveness scores which is visible in most South Korean dating applications but invisible in other applications. For the applications that conceal the scores of their users, nine participants developed strategies that indirectly reveal them. Our participants described how they estimated scores based on the number of matches they

obtained when expressing ‘Likes’. They believed that a higher number of matches signified a greater popularity which also indicated higher attractiveness scores. Subsequently, a few participants explained their self-experimentation process, in which they sent ‘Likes’ to every recommended online dating profile and monitored the number of matches formed.

Another strategy that our participants used to unpack the scoring algorithm was by estimating the attractiveness of the recommended profiles they received. P21 explained how she understood her attractiveness level: *“It kind of shows that your approximate ranking is about here ... I feel it by the group of men I match in the app, I realize that I can meet men at about this level, and (for the men who I couldn’t match with) these type of men are too high for me.”*

Our participants also frequently used the online dating services to improve their self-values. For this, some participants constantly made changes in their profile photos, tracked the changes relating to the attractiveness scores, and used them to build on their physical attractiveness. By experimenting with their strategies of estimating attractiveness scores, participants were able to see the impact of changes in their looks, styles, communication styles, and even personalities on the results. Based on the experiment, six participants answered to have developed styles that are far from their own preference, but seemed more desired by potential daters, and even applied them to their styles in real-life. Furthermore, participants described the satisfaction they experienced after changing their styles, which consequently had a positive impact on their self-esteem. P12 shared his personal experience: *“I felt the change in myself not only online, but also offline. So I began to ask people out ... Since my self-esteem is higher and I’m satisfied with myself, I became more active in forming relationships. It’s really like a butterfly effect”* Six participants reflected a further desire to use the algorithm as an indicator for understanding how others perceive them, and what their attractive points are. P12 demystified how he would like to use the system to track his changes in attractiveness: *“Like when you exercise, you want to lose weight, so when I look at my percentage, I was top 9%, but now I am 8%, sometimes 7%. Like this, if the system were something I can use to track my changes, I think I would be able to judge if I am growing in a more desirable direction.”*

4.3 Employing extreme self-presentation strategies for achieving higher attractiveness scores

A number of participants shared their experiences on how they felt discomfort with the algorithms’ evaluation system. We found that eight participants experienced algorithmic anxiety when they feel their scores dropping and being filtered out from the the higher-scored group of people they used to belong to. This anxiety came from participants’ perception that lower scores and ratings within the matchmaking system diminish their chances of pairing with a desirable potential partner. Compounding this issue was their uncertainty about strategies to enhance these scores. As this anxiety escalates, a subset of participants even worried that they may be excluded entirely by the algorithm thus becoming invisible to other users. P13 interpreted her past experiences of feeling algorithmic anxiety: *“So I thought to myself, I’m the discarded card, and if this situation continues, I won’t be matched with anyone.”*

In response to such anxiety, we found that our participants became more obsessed with self-presentations and receiving more likes. For this, some participants frequently sent ‘Likes’ to the recommended profiles with the presumption others will give many ‘Likes’ in response. P6 explained her confused and worrisome past experience when she noticed that her scores dropped: *“I was like, should I upload my better looking photos? should I upload good music taste?.. I think I’ve become self-conscious. I had a hard time taking pictures, picking one out of 100 pictures, and I thought, ‘Why am I doing this?’”*. Furthermore, this feeling of anxiety induced participants to feel competitive toward other users. When they received scores that do not meet their expectations, they started to compare themselves and their profiles with other users within the platform, which subsequently

led to jealousy and a decline in their self-esteem. As mentioned by P2, this lack of self-esteem and comparing behaviors even led to extreme thoughts like having plastic surgery: *"I'm jealous. I found myself thinking, If I were to get that score, my eyes should be bigger. If my eyes were prettier, my scores would have been higher."*

These feelings of anxiety paired with a lowered self-esteem made some participants to engage in actions that they feel uncomfortable, but perceived as potentially beneficial to improve their scores. For example, P5 shared her experience on how she used to upload revealing photos of herself for more likes and improved profile scores, but deleted afterwards: *"I felt the feedback was better when my photos were more revealing, or showing my body line. I didn't want to post things like that, so I used to upload rather ordinary pictures, but if I feel they(the reaction and feedback) were different from what they used to be(when I seem to be less popular), I uploaded them(revealing photos) again."*

After constant effort for better scores, five participants answered to feel a reality hit at some point. When this happens, they deleted the dating applications, looking back at their initial purpose of accessing the applications. However, after some period, some participants re-installed the application, and answered to have repeated this loop of application installation and delete.

Other participants tended to blame the unknown fellow online daters after the efforts made for improved scores. This was because they believed that the evaluation of other online daters somewhat affect the scoring of their profiles. As the participants do not know who and how their profiles were evaluated by, many directed their resentment towards the whole unidentified users, resulting in feelings of anger, derogation and ridicule towards them. Due to these escalating negative perceptions, some participants took actions of revenge using the algorithmic system. P13 shared his experience on how he used the scoring system with the intention of inflicting emotional harm: *"I gave bad scores on purpose. Even if they have a pretty face, I gave 3 points(out of 5), if they have an average face, even lower ... Since I won't be matched with them anyway..."*.

5 STUDY 2: PARTICIPATORY DESIGN WORKSHOP USING METAPHORIC DESIGN

Through our interviews, we gained insights into how online daters feel and behave in online dating platforms knowing that they are being evaluated by the algorithm. Overall, our research revealed that participants experience challenges interacting with online dating services, such as a tendency to focus on assessments rather than building relationships leading them to pose strategies to find out their attractiveness scores. Consequently, we recognized the necessity for the study that encourages participants to engage in a critical discourse about their online dating experience, pinpointing algorithmic elements that precipitate challenges found in Study 1. To address this, we conducted a participatory design workshop aimed at identifying algorithmic features that could reshape the online dating algorithm experience to align with the participants' desires and intended outcomes from these platforms.

5.1 Recruitment

We tried to recruit participants who meet two criteria: a user who (1) have in-depth engagement of at least one dating application for at least one month, and (2) is interested in sharing their thoughts and discuss personal dating experience with other group members. Recruitment flyers were posted at online university boards and student communities in South Korea. 43 South Korean participants responded, 24 female and 19 male, aged 19-34 ($M = 24.95$, $SD = 3.82$).

5.2 Participants

Based on the survey results, we selected a total of 15 people for 5 participatory workshops, with 3 participants in each group. We selected participants who expressed interest in participating in the participatory design workshops. The demographics of the final selected participants are shown

in the table 2. Due to the sensitive nature of dating, we assumed that some participants may feel hesitant to share their online dating experience with specific genders, or to disclose their sexual orientations during the study. We therefore grouped the participants based on their preference of gender and sexual orientations. Most participants ($N = 39$) identified as heterosexual, while four identified as bisexual. These four participants, who were also friends, expressed a preference to be grouped together in the study to create a more comfortable at

Workshop Session	Participant	Age	Gender	Usage Period	Purpose of online dating
W1	P1	22	M	~1 month	Casual relationship
	P2	27	M	~1 month	Casual/Romantic relationship
	P3	28	M	6 months~1 year	Casual/Romantic/Serious relationship
W2	P4	19	M	~1 month	Casual relationship
	P5	29	M	1 month~6 months	Casual/Romantic relationship
	P6	24	M	1 month~6 months	Casual/Romantic/Serious relationship
W3	P7	23	F	1 month~6 months	Casual/Romantic relationship
	P8	21	F	1 year~3 years	Casual/Romantic relationship
	P9	20	F	1 month~6 months	Romantic relationship
W4	P10	25	F	3 years~	Curiosity
	P11	32	F	1 year~3 years	Romantic relationship
	P12	32	M	1 month~6 months	Romantic/Serious relationship
W5	P13	28	M	1 month~6 months	Romantic/Serious relationship
	P14	20	F	6 months~1 year	Casual/Romantic relationship
	P15	23	M	1 month~6 months	Casual relationship

Table 2. Demographics of Study 2 (participatory design workshop) participants.

5.3 Workshop Materials

We carefully designed materials for our participatory design workshop. Regarding the sensitivity of the topic, we prepared self-introduction sheets so that participants could become familiar with each other as the overall workshop included group discussions about their romantic relationships (Fig. 2).

We then provided ‘challenge cards’, a set of the problems of online dating algorithmic features identified from Study 1 (Fig. 3). The cards consisted of a catchphrase that captures the end-user concerns, with quotes from the interview which can help participants better understand the challenge. For example, card 1 was written with a catchphrase, ‘The endless loop of infinite evaluations’ with a quote “*Even though I don’t have an intention for a conversation, I habitually evaluate others when I’m bored. I just glance at the profile and continue swiping. It really felt like just a game.*” (P5 of Study 1).

Finally, participants were asked to envision novel algorithmic experiences that address the challenges described in the challenge card they picked. To facilitate idea generation, we employed metaphoric design technique [57, 61, 62]. The rationale behind our use of metaphoric design stems from the recognition that algorithms can often be perceived as complex or akin to ‘computational logistics’ by many people. As a result, designing new algorithmic operations is a notably challenging task. To mitigate this, we introduced a technique that leverages everyday objects to facilitate understanding. This approach allows participants to recall the inherent properties of these objects and map these characteristics onto how an algorithm could function. For instance, considering an ‘ice’ metaphor, with attributes like ‘melting into water’ or ‘revealing enclosed items only when melted’, one could envision an algorithm that, similar to ice, gradually discloses profile content as interactions between matched individuals progress, rather than revealing everything upfront. This metaphorical thinking was pivotal in our participatory design process for algorithmic features.

To implement this, we provided participants with metaphor cards during the design sessions. These cards were developed based on existing literature on metaphoric design by Logler and Lockton [61, 62]. For the creation of these cards, our team initially selected metaphors offering unique perspectives to assist participants in re-imagining. We chose objects from the vast array of items in the iOS 16.4 emoji collection for our metaphors, as these emojis represent everyday objects familiar to most people [28]. Each selected object was then accompanied by content on the cards to aid participants in grasping the concept more concretely. To define the most common characteristics of each object without introducing the authors' subjective biases, which could influence the outcome of the study, we utilized ChatGPT-4. For every object, we consistently prompted ChatGPT-4 with 'Give me five simple qualities of a (object)'. Out of the five characteristics provided, we selected two that were not only widely representative but also uniquely relevant to the object in question (Fig. 6).

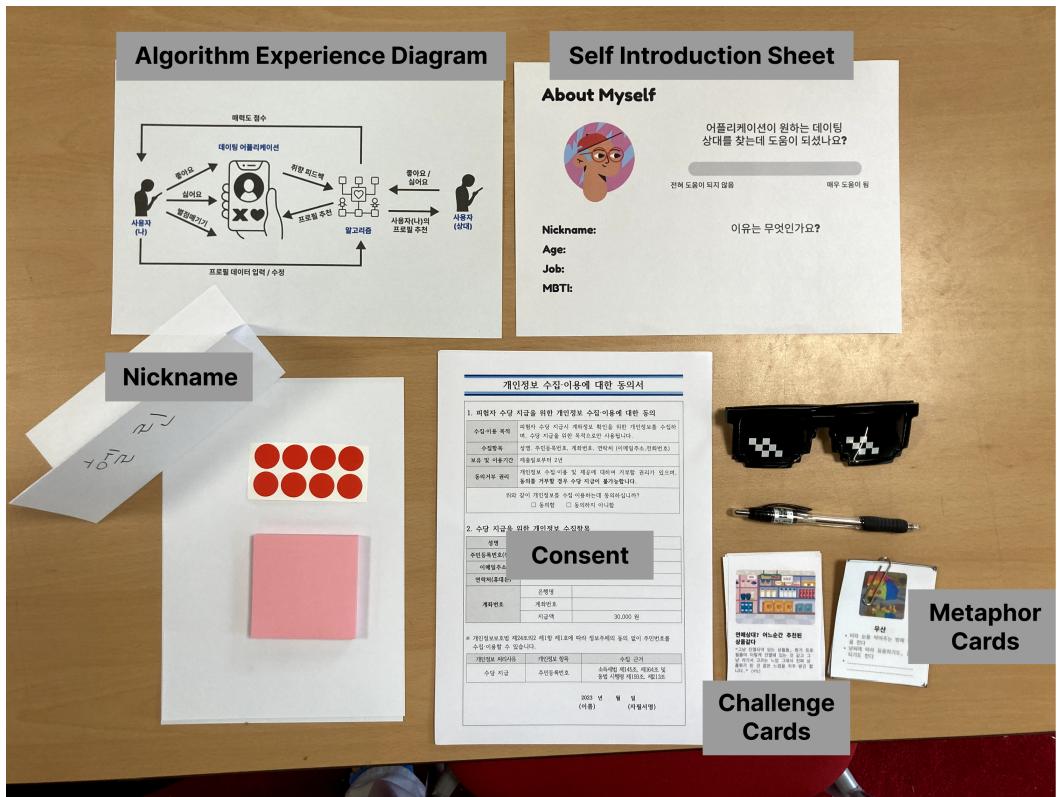


Fig. 2. Workshop materials including: Algorithm experience diagram, Self-introduction sheet, Nickname tag, Challenge cards, Metaphor cards, and a consent to agree in data collection of the workshop.

5.4 Workshop Protocol

Our goal for the participatory workshop was first, to investigate algorithmic attributes that are associated with the challenges of online dating, and second, to derive design ideas for an algorithm system that meets their goals for authentic, positive human connections.

Ice Breaking & Emphathizing with Challenges. Our workshop began with self-introductions for ice-breaking. For the next session, participants were introduced with the 10 challenge cards, and were instructed to select and reflect upon three to five cards that resonated with them personally, sharing their experiences and the reasons for their empathy with these specific cards. This exercise facilitated a recollection of their individual online dating experiences and promoted awareness of the problems based on personal encounters with online dating.

Phase 1: Group Discussion on Algorithmic Challenges. Subsequently, participants engaged in group discussions to align the challenge cards (Fig. 3) with algorithmic features of online dating (Fig. 4). During these sessions, they collaboratively discussed on what could have been the cause of the challenge cards from the algorithm system. Through this activity, we aimed to help participants recall their memories on online dating, and bring the challenges into the algorithm system mapping the cards on the algorithm diagram (Fig. 5).

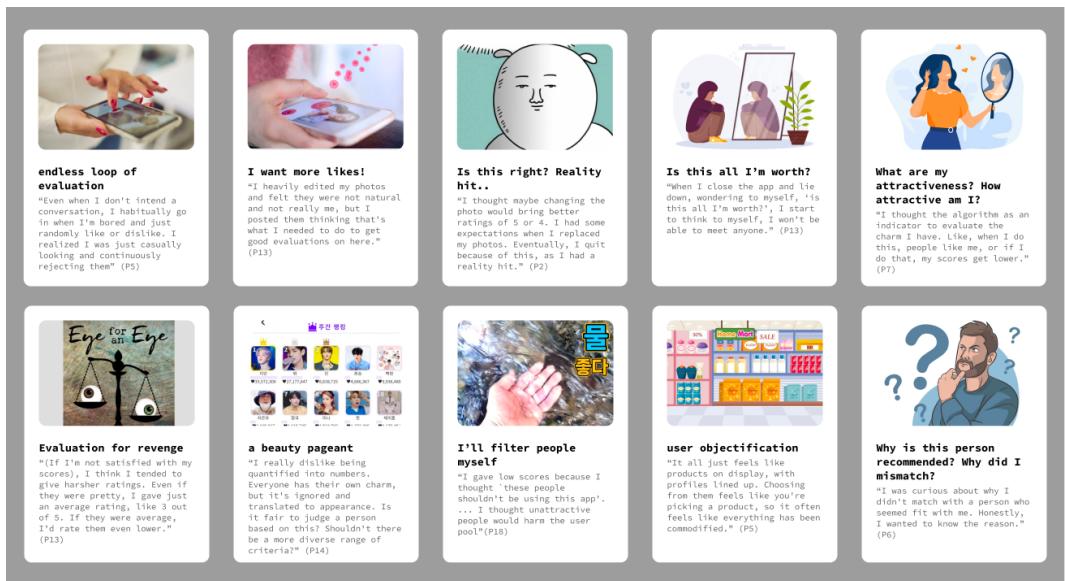


Fig. 3. Challenge cards: Grouped findings addressing the challenges mentioned from interviews of Study 1.

Phase 2: Individual Design Activity with Metaphor Cards. After the discussion, participants were made to design algorithmic features that could mitigate the challenges they discussed. Among the 30 metaphor cards we designed, three of the participants in each group were each provided with 10 randomly selected metaphor cards, and were guided to design algorithmic features, using the metaphor cards as an inspiration for their ideas (Fig. 6). The session lasted for 20-30 minutes, and the participants shared their ideas afterwards by mapping them to the algorithm diagram, explaining and discussing their ideas with each other (Fig. 5).

5.5 Data analysis

All sessions were in Korean, and voice-recorded with participants' permissions. The recordings were transcribed, and workshop results on the Miro Board and physical materials were documented in Google Docs and Spreadsheets. Two researchers first tried to analyze the outcome of Phase 1, by mapping user-generated materials into a single diagram which is also shared to the participants. Then, we tried to observe the major pattern by considering numeric majority of the annotations.

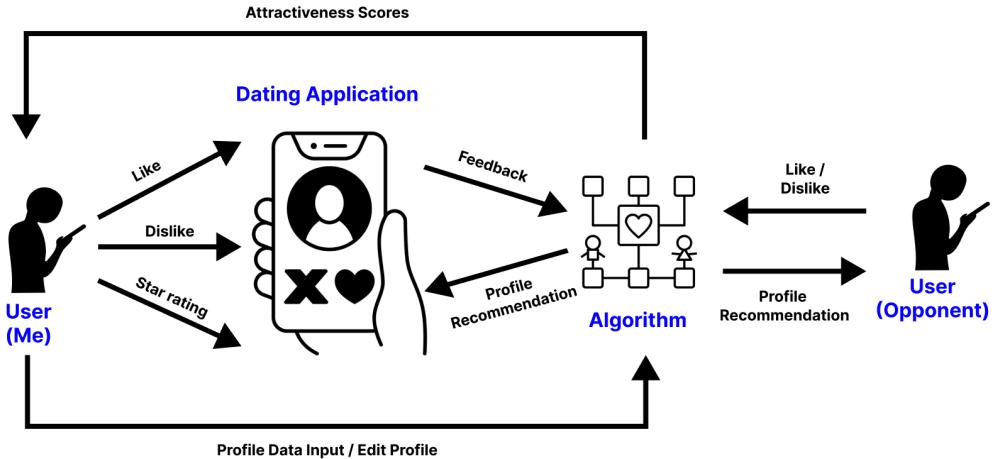


Fig. 4. Algorithm Diagram: We designed a diagram that reflects the algorithmic experience of users described by the algorithmic features for matchmaking. During the workshops, participants were made to map the challenge cards and algorithmic design features on this diagram.

To analyze the design suggestions derived in Phase 2, we conducted thematic analysis by reading transcripts and coding notable patterns and topic sentences. After coding workshop data, we generated high-level groupings and their themes by the purpose of solution design. The quoted statements in this paper were translated into English. We categorized the emerging themes into three goals of user desires, which we will describe in the following section.

6 STUDY 2 FINDINGS: USER GOALS DERIVED FROM ALGORITHMIC FEATURES DESIGNED BY PARTICIPANTS

Through the analysis of data collected from our workshops, we gained insights into the algorithmic features desired by our participants which could mitigate the challenges derived from our study 1 (Fig. 3) and foster an improved online dating experience. We organized the designed algorithmic features from our workshops into three themes: 1) exposing the most honest personal values, 2) optimizing matchmaking features depending on the potential dating partner, 3) achieving personal growth in romantic relationships with support from the dating algorithm. These themes represent the goals that our participants aim to achieve through the designed algorithmic features.

During our five workshops with 15 participants, our participants were able to determine algorithmic problems, and subsequently provided 88 design solutions using the objects and descriptions provided by our metaphor cards, all within the workshop period of 60 to 90 minutes. All of the 30 different metaphor cards we provided were used for design ideas, with 'Umbrella' and 'Gatekeeper' used most (5 times each) and 'Soccer', 'Tree', and 'Dolphin' used least (1 times each). Overall, the number of design ideas was rather evenly distributed between the cards. The vast majority of discussions arising from our workshops were related to user concerns and desires toward the algorithm experience in online dating situations. Despite the diversity and varied details of design solutions, we identified several overarching goals that share similar solution properties detailed in section 6.2.

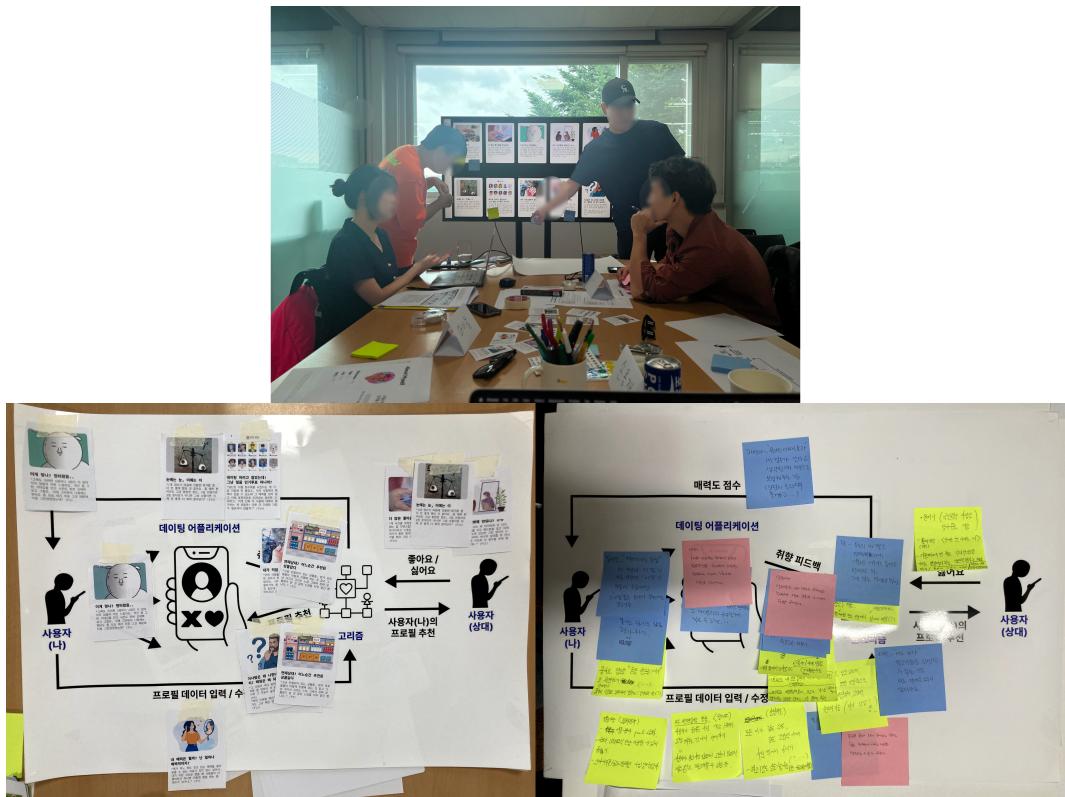


Fig. 5. (Above) Participants of Group 1 conducting design workshops, (Left) The outcome of the first activity of the workshop, Group 5, (Right) The outcome of the second activity of the workshop, Group 4

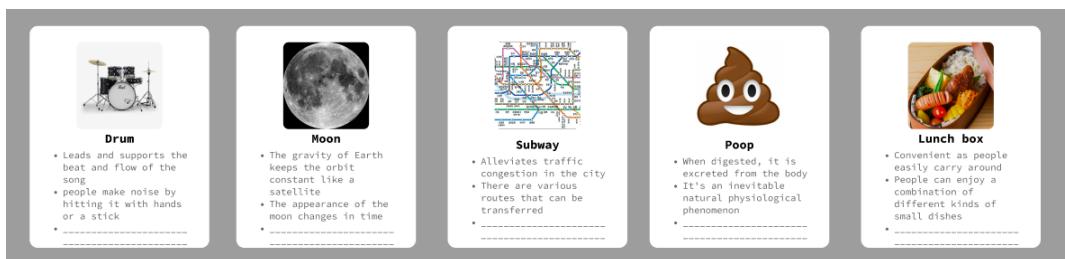


Fig. 6. Five examples of the metaphor cards used throughout the participatory design workshop

6.1 Goal 1: Exposing the most honest personal values

Through our data analysis, we found that our participants reflected a desire for a system where they can freely express the honest self, and receive recommendations considering such values.

6.1.1 Challenges: Fast-paced, visual-centric evaluation of dating profiles. Our participants pinpointed a significant issue: the algorithm system's tendency to emphasize the physical attributes of potential dating partners, which often overshadows the objective of establishing human relationships. This focus on appearance-oriented assessment in online dating, highlighted in Study 1, was further

explored in Study 2. Here, the workshop participants noted that the endless profile recommendations, encouraging superficial, single-swipe assessments, are a key contributing factor to this problem.

Participants pointed out that the current profile design paired with fast and endless recommendations led them to become highly obsessed with their appearance, addressing the challenge of ‘a beauty pageant’ depicted in the challenge card, consequently leading many to develop a fabricated persona to win the popularity game. P7 pointed out: *“But you know, when it comes to star ratings, recalling the fact that other online daters will rate me as well, I feel like I’m constantly creating a fake version of myself.”*

6.1.2 Solutions: Navigating diverse contextual and situational values of individuals. To address the challenges emerging from visual-centric evaluations, many of our participants designed algorithmic features which prioritize the match of the values beyond appearance and basic demographics. They mentioned how not only do photos often fail to capture one’s actual appearance, but factors such as physical appearance and basic demographics fail to represent the authentic aspects of self. For this, our users suggested an algorithmic feature that allows them to assess the diverse values of a potential partner, rather than just assessing the profile with a glimpse. This approach, as posited by our participants, necessitates a process where users can convey their preferred individual values to the algorithmic system. P11 provided an example using ‘Lunch box’ as a metaphor, utilizing its quality of ‘People can enjoy a combination of different kinds of small dishes.’ as: *“Instead of liking the whole profile, like ‘a part’ of the profile, and the algorithm can collect the parts that I liked and use them for a recommendation.”*

While the previous ideas incorporated the concept of how an algorithm system can accept various values of users, we were able to extract the types of values that our participants desired for the algorithm to consider for their matchmaking. Three participants emphasized the significance of the algorithm taking into account contextual or situational values that change by time. The rationale behind this approach originates from the participants’ understanding that human relationships are significantly influenced by the dynamic states of individuals, which are subject to change. P11 gave an example using the quality of the moon’s appearance as a metaphor that varies from time to time: *“The moon changes its shape in time. Likewise, choose your mood for today, or select music that suits your mood, and then the algorithm will recommend a match who fits that mood.”* Furthermore, two of our participants expressed a need for matchmaking considering in-depth personal data such as one’s weaknesses. They explained how revealing imperfections is crucial for intimate relationships. P8 suggested examples using ‘Poop–When food is digested, it is excreted from the body’ for a metaphor: *“As embarrassing and honest as it gets: Make people write their flaws or honest shortcomings in their profiles.”*

6.2 Goal 2: Optimizing matchmaking features depending on the potential dating partner

We revealed that participants are looking for algorithmic matchmaking that automatically adjusts its features based on user preferences. They want a system that not only grasps the dynamic nature of dating, including individual dating styles and personal circumstances but also one that can adapt real-world tactics to optimize dating strategies for a variety of potential dating partners.

6.2.1 Challenges: Beyond a standardized matchmaking process across online daters. During our first activity mapping challenge cards to the system, participants pointed out how the current matching algorithm amplifying uniformity across all users results in many challenges. They highlighted that users are relegated to a passive role, limited to expressing interest and affection in algorithm-suggested profiles through likes or star ratings. As mentioned by P1: *“We only have the dichotomous option of a Like or Dislike, or even star ratings are done in five numbers.”*

Furthermore, participants highlighted the issue with the uniform profile template used for all users. They suggested that this, combined with the algorithm's continuous stream of profiles requiring quick swipe-based assessments, could lead to a superficial evaluation of profiles, where users pay little attention to each individual profile. This setup, as they explained, might contribute to challenges such as an 'endless loop of evaluation', and 'user objectification'. They also voiced frustration and discomfort with the app's limitations in supporting users' efforts in their dating pursuits. As P5 stated: *"On Tinder, I feel like there aren't enough ways to really hype yourself up, you know? They do have that bio section, but seriously, almost nobody puts in a sincere effort into making their profile appealing."*

6.2.2 Solutions: Employing diverse styles of matchmaking adaptive to potential dating partners. Consequently, our research revealed a strong preference among participants for a matchmaking algorithm that embodies their individual approach and efforts they invest in real-life romantic relationships. Some participants suggested a algorithmic feature that would allow them to modulate the speed of the matching process, which would be determined by the algorithm's assessment of their compatibility with potential matches. For example, P1 suggested: *"Just like subways where people can choose either express lines or general lines, I want a system in dating so that if I find someone I like, I can match and talk with them quicker to see if they are a good match for me, as it takes a long time and is bothersome to have a conversation after matching on Tinder."*

Some participants envisioned an algorithm that would allow them to demonstrate their emotional investments and measure the level of interest toward a potential partner. Instead of a system where affection is shown only through likes, they proposed inventive methods for expressing stronger emotions towards those they are particularly interested in. For example, P10 drew an analogy to the sound of a drum, varying with the intensity of the hit, and applied this concept to an algorithmic feature for gauging the effort behind a 'Like': *"Imaging measuring the degree of 'liking' by the intensity of shaking the phone. A feature that communicates to the other person the effort you've put into sending that like."*

Many participants suggested an algorithm capable of dynamically customizing one's profile to better match the preferences and tastes of potential dating partners. This reflects their desire to enhance the likelihood of finding a match. As P2 illustrated: *"It's like tailoring a resume to fit a specific company's requirements when job hunting. Similarly, it would be beneficial to adjust one's dating profile to align with the interests of the other person."*

6.3 Goal 3: Achieving personal growth in romantic relationships with support from the dating algorithm

We revealed that participants yearned for an algorithmic system designed to actively support their matchmaking process and their personal growth in romantic relationships.

6.3.1 Challenges: Lack of explanations on one's matchmaking situations. Both Study 1 and Study 2 findings revealed that users of online dating applications tended to exploit the algorithm to gauge their perceived value in the dating market, as evidenced by their scores, the number of likes on their profile, and even the frequency and quality of partner recommendations. However, a significant challenge emerged due to the lack of clear explanations about how these scores were determined or why certain partners were recommended. The lack of clarity often led to a sense of algorithmic anxiety among users, as they were left to speculate about the reasons behind their low scores or scant matches, as depicted in the card 'Why is this person recommended? Why did I mismatch?' or 'What are my attractiveness? How attractive am I?'. To counter the issue, many participants resorted to various experiments, such as changing profile pictures to see if it affected their scores. One participant, P12, shared: *"Since it's all managed by an algorithm, we're honestly clueless about*

what happens inside the system... And when it recommends someone completely unexpected, I can't help but wonder if my profile or something about me isn't appealing enough." Overall, our findings underscore the need for more detailed, personalized explanations and support throughout the matchmaking process. Such assistance is not only crucial for users to secure more compatible matches and refine their online dating strategies, but it also serves as a motivator to continue using the matchmaking algorithm system.

6.3.2 Solutions: Facilitating the entire online dating experience from the creation of attractive profiles to the building of authentic relationships. Several workshop participants suggested the development of an advanced feature designed to optimize user profiles for more effective matchmaking. For this, our participants emphasized the desire for a highly personalized assistant, one with which they could establish a connection, thereby feeling more comfortable sharing detailed personal information. Proposed enhancement to the algorithm included a functionality that could automatically identify and suggest improvements for less appealing aspects of a user's profile based on the data accumulated. For example, P10 highlighted the potential of an AI-driven photo editing tool: "*Imagine an AI feature that adjusts the color and ambiance of the photos we upload. Since there's a lot of apprehension about photo selection for profiles, the kind of tool could really help ease those concerns.*" The suggestion underscores a keen interest in algorithmic solutions that not only enhance user profiles but also address the common anxieties associated with online self-presentation.

Our participants also designed algorithmic features focusing on fostering personal bonds between users and the algorithmic system. The findings highlight that many participants grappled with reduced self-esteem or a tendency to cast blame on themselves or others. In such moments, overshadowed by these negative emotions, there emerged a clear need for a system capable of offering not just encouragement but also a sense of connection with the algorithm. This would strengthen their determination in the ongoing search for a suitable partner. One idea, as P11 suggested by using a 'cat' as a metaphor, was the creation of a more tangible 'matchmaker' presence within the app: "*Imagine the AI manifesting as a friendly figure or icon within the app, allowing users to form a bond with it. This feature could serve as a source of support and encouragement during the dating process.*" Such a concept points towards an empathetic approach in algorithm design, aiming to nurture a more engaging and supportive user experience.

Our participants proposed a variety of algorithmic solutions tailored to cheer users facing dating challenges. One particularly intriguing concept involved an algorithm that bolsters user morale through positive reinforcement. For instance, P7 who mentioned a 'Drum', likened this idea to the empowering effect of drumbeats: "*Just like how drums produce a strong, confident sound, right? So, the app should also take on the role of providing positive feedback. This could prevent users from feeling undervalued and help them celebrate even small victories. Imagine if the app could not only boost their confidence but also make them feel like they're achieving something significant. This kind of uplifting feedback would likely keep users' spirits high, making them more active and engaged.*"

Furthermore, we found that the participants not only sought out specific feedback from the algorithm but also yearned for a more comprehensive management system. This was often described in terms of the algorithm functioning as a personal 'dating coach'. Such a system would be perceived as an ally, actively supporting users in their dating journey. For instance, P5 envisioned a more nuanced approach using an analogy of a 'bag': "*It's not just about ticking boxes on a checklist. The algorithm should offer detailed guidance on how to create compelling profiles. It should encourage users to put thought and effort into crafting their profiles, making them more appealing.*" This concept suggests a shift towards a more interactive and supportive algorithm, one that goes beyond mere mechanical suggestions to providing personalized, actionable advice, thereby fostering a sense of partnership in the dating experience.

7 DISCUSSION

In this work, we first investigated the emotional and behavioral challenges users experience when interacting with online dating algorithm systems based on the belief that they are scored by the algorithms. Furthermore, we identified the unseen negative consequences of online dating platform, which hinders users from achieving their primary goal as a relationship formation. Drawing on the insights from the interviews, we delved deeper into the underlying reasons for those challenges, subsequently identifying user-desiring algorithm features which mitigates the challenges for an improved online dating experience.

7.1 The Complexity of Folk-Theories in Online Dating Algorithms

In the realm of algorithm-centered platforms, the opacity of algorithmic features emerge as a pivotal concern, echoing broader discourses around algorithmic explainability, transparency, controllability and user agency [34, 64, 88, 89]. Users, often left in the dark about the inner workings of these algorithms, are inclined to create their own folk theories to make sense of the algorithmic processes and outcomes they encounter [29, 48, 101]. Folk theories, which are the beliefs formed by users to make sense of their algorithmic experiences [16, 29], have been widely researched in the context of social media feeds [29, 78], content recommendations [51], and gig economy work experiences [41, 102] to understand how platform users make strategies to take advantage of the algorithms [51], avoid specific algorithmic influence [80], and negotiate the algorithms' decisions [92]. In the context of online dating platforms, prior studies indicate that users perceive these algorithms primarily as a filtering tool that refines their potential matches, and that their past interactions on the platform shape the algorithm's recommendations [48, 71]. Furthermore, users believe algorithms assign attractiveness scores to individuals, categorize them into brackets based on these scores, and subsequently matches between users within the same bracket [48]. Moreover, it is known that users believe the operation of these online dating algorithms as simplistic, primarily of the simple and repetitive experience of these platforms, and the limited data users enter into the systems [83, 86]. Our findings also confirm that this perception strengthens the user's understanding that matchmaking algorithms primarily rely on superficial data such as the number of likes to assess a user's attractiveness.

Building upon the prior scholarly work, we examined the online daters' beliefs on the algorithms' evaluation based on attractiveness of user profiles by delving into how users perceive and behave when experiencing algorithmic evaluation features in Study 1. Through this investigation, we were able to find some unexpected breakdowns and behaviors far apart from the original purpose of using this platform — meeting their partners and building romantic relationships [6, 27, 40]. The findings include user perceptions on the algorithmic matchmaking features as inefficient, since they are made to spend time in numerous appearance-centered matching and have to take the process of looking for the most fit person by themselves. Also, a few of our study participants reported that they even pose extreme strategies such as posting sexualized photos of themselves to gain more likes and higher attractiveness scores.

Moreover, we found a conflicting user desire to the existing algorithmic folk theories in online dating, such as requesting for transparent algorithm, as users wish for more complex and personalized matchmaking algorithms that mirrors the multifaceted nature of human relationships in the real world. These findings were particularly evident in Study 2, where users expressed a preference for systems that reflect a broader range of personal values and facilitate matches based on these deeper human dimensions. From a certain perspective, it seems natural for users to form such goals. The reason lies in the complexity of real-world dating life, which is not merely based on appearance and basic demographics, but rather is a complex amalgamation of emotions, biases,

beliefs, and situational factors [65, 68]. However, algorithmic transparency should be implemented carefully, particularly regarding the collection and processing of highly sensitive personal information of online dating platforms. A number of prior research discuss the possible trade-offs as associated with increased transparency in algorithmic systems, including risks to user privacy [13, 73], susceptibility to manipulation [76], and compromises to user autonomy [21]. For instance, the algorithm may suggest users to alter their profile based on what is deemed more attractive or effective for their matchmaking. This could potentially lead them to adopt personas that do not reflect their true selves, which could echo the same challenges of online dating applications from our findings 4.3. To uphold user autonomy and implement our design recommendations appropriately, it is crucial to adopt clear privacy policies regarding data collection processes, usage, and protection measures [4, 56]. Also, carefully curated explanations in detail about why certain profile changes are suggested and their potential impacts on the user's dating experience should be provided [19, 77].

While acknowledging these issues is crucial, our study contributes a distinct perspective by examining how the design of online dating algorithms influences user behavior and self-perception. Our findings indicate that these algorithms prompt users to modify their dating preferences and behaviors to align with the mechanics and assumed values of the system. This adaptation often leads to a diminution of the users' complex emotions and personal values. Such findings advocate for a balanced approach in algorithmic transparency that not only addresses the operational aspects of algorithms but also considers the broader impact on human values and social interactions.

7.2 Far from Romantic Relationships: Unraveling the Negative Influence of Dating Algorithms on Users

Our findings revealed that the use of algorithmic online dating applications leads to unfavorable impact and challenges on users' behaviors and attitudes. Notably, users experienced algorithmic anxiety when their scores dropped down, and exhibited extreme thoughts such as considering cosmetic surgery in response to their dissatisfaction with system-generated scores. To be evaluated as 'more attractive', users experimented with various strategies such as uploading provocative images or sending likes to every recommended profile with expectations to receive more likes back – which are actions they might not inherently favor but believed to be effective in improving their scores. These findings align with prior research on the impact of user interactions with online dating websites, which suggest that platforms emphasizing visual appearance can reinforce biases towards certain physical traits, potentially fostering discriminatory behaviors [49, 66]. Thus, our research extends this discussion by examining how algorithmic interactions can also precipitate self-destructive behaviors, while existing studies primarily explore the hazardous behaviors and perceptions directed towards external factors. Moreover, our findings resonate with previous studies in algorithmic uncertainty where users modify their behavior in hopes of favorable outcomes from opaque algorithmic systems in social media platforms [78], gig economy [53, 102], and creator economy [11], further contributing to these research by adding how algorithmic features, mainly the endless visual centered profile recommendations with a lack of explanations, amplify such behaviors in the context of online dating.

In the unique context of dating, engaging with algorithms on dating platforms can demand a significant emotional investment from users. We found a notable shift in users' attitudes towards relationships was observed, with many perceiving them more casually over time. The less serious approach towards relationships can be associated with prolonged engagement with online dating platforms, and this may be seen as stemming from the commodification of romantic connections as discussed in previous research [42].

In a same vein, we highlight the complex emotional dynamics at play by observing users' cyclical pattern of app deletion and re-installation, underscored by a mismatch between initial usage intent and expectations, and subsequent behaviors. While users accessed the online dating services with the intention of forming romantic relationships [6, 27, 40], the current online dating experience, which often emphasizes the importance of self-presentation in a highly comparative mode, may lead some users to feel emotionally exhausted. This, in turn, could potentially decrease engagement with the apps and even lead them to leave the platforms in the long-term. Through our study 1, we found that many users experience a reality hit after their constant effort for self-presentation due to a mismatch of their behaviors and their initial goals in online dating—finding love, which accordingly induced them to leave the applications, and have a cycle of application installation and delete. Online dating is not the only platform where concerns on users' behavioral cycles due to emotional distress or potential hazardous behavior has been discussed. Prior studies on algorithm-mediated services, including platforms like Facebook, YouTube, or TikTok, suggests that the long-term continuation of negative algorithmic impact and defying expectations may result in high-stake users (e.g., creators, crowd workers) leaving the platform, even as a collective action [7, 24, 50, 60]. Even dating context is not a professional context but more personal and relational, users should feel safe and stable about using the platform and services.

Our work contributes to the landscape of algorithm-based platform research by highlighting how the influence of algorithmic features may play a role in shaping long-term user responses to online dating services. Our findings provide insights in raising awareness about the potential risks, such as self-deconstructive perceptions and behaviors, associated with online dating services, which could in time affect user long-term user behaviors such as a cycle of application installation and delete.

7.3 Beyond Matchmaking: Understanding User Desires to Improve Oneself

The landscape of online dating algorithms has been extensively researched, covering diverse aspects such as user motivations, algorithmic beliefs, and self-presentation strategies [26, 36, 48, 71, 94], particularly focused on understanding user interactions with online dating algorithms, such as user strategies for a boost in their attractiveness scores, or user behavior to effectively commodify themselves for more matches [71, 75]. These investigations, while insightful, have primarily concentrated on the users' presentation towards appealing to others, such as enhancing match probabilities by optimizing user profiles.

In contrast to this established body of work, our research introduces a different perspective as users were found to use the attractiveness scores as tools for self-improvement and personal support. This divergence is grounded in our interview findings, which reveal online daters' desires to reflect on themselves to understand and define their strong and weak values in self attractiveness and to improve them. Participants perceived the algorithmically calculated scores as an objective measurement of their own attractive points and reflected a desire to utilize them to improve themselves. Accordingly, we found that online daters use various strategies such as estimating the attractiveness of suggested profiles as a mirror to gauge their own desirability. They meticulously track changes in their self-presentations and monitor the resultant fluctuations in attractiveness scores. This approach is not solely about increasing match likelihood but is focused on understanding which aspects of their personas are deemed attractive by others.

These findings echo existing literature about self-reflection issues in online dating which focus on user urges and strategies to understand how others perceive them, and their attempts to experiment with qualities through profile stylization [23, 90]. In addition, we highlight the potential benefits of online dating algorithms for self-improvement and support as they may act as a key feature supporting users' self-esteem. Existing literature on online dating services has been concerned

with its relation with psychological distress as many online daters report high rates of depression, internalization, appearance comparisons, body shame, and low levels of self-esteem [5, 45, 91]. Extending concerns on the current online dating platforms, our interviews noted that active engagement in defining self-values and improving them by utilizing the algorithm led some users to have a positive influence on their self-esteem, along with self-confidence in their dating in real life. These findings indicate that shifting focus from self-presentation strategies to identifying and improving their own charms may be the key to an improved online dating experience. Moreover, our findings from Study 2 also indicate that users desire for an algorithmic feature in which the system encourages users with positive feedback to foster their confidence. Here, we suggest that careful design of explainable features of online dating algorithms could potentially aid users in their online dating experiences.

7.4 Lessons From Using Metaphor Cards in PD with Online Daters

Participatory Design (PD) is gaining increasing popularity within the HCI and CSCW communities [11, 14, 58], as it enables researchers to deeply understand the needs and motivations of stakeholders from a wide array of backgrounds [104]. Through our study, we found three major benefits of applying a metaphoric design approach [61, 62] in PD for designing algorithmic features for online dating: 1) empowering diverse perspectives and individual adaptability, 2) enhancing communication and empathy, and 3) thinking out of the box.

First, online dating services deal with the connections between individuals. Therefore, it is crucial for workshops to be designed to craft experiences for such platforms to facilitate the generation of ideas that reflect individual identity, personal experiences, and cultural diversity [18]. Metaphors inherently offer the flexibility to be understood in various ways, making them especially effective for resonating with a wide range of users [55, 57]. In the context of online dating, we found users utilize these characteristics to convey their identity—whether it pertains to sexuality, or personal understandings—in nuanced ways through metaphorical expressions [25, 97]. For example, multiple users used the metaphor ‘drum’, but viewing its’ quality of ‘people make noise by hitting it with hands or a stick’ in a different perspective: One participants were inspired by the empowering sound of drumbeats, designing features of the algorithm providing positive feedback on user charms. Another participant focused on the hitting action itself, designing features for gauging the user effort behind a ‘Like’.

Second, metaphors have the ability to distill complex ideas into simpler, more relatable terms [84]. A well-chosen metaphor that carries a concept that people can easily understand can bridge the complex ideas and make these concepts more accessible [57]. In the context of online dating, this is invaluable because relationships involve complex emotions and dynamics that can be difficult to articulate or comprehend. Furthermore, the concept of an algorithm is complicated for most users, therefore most participants may have difficulty thinking of ideas from scratch. Here, using metaphors made it easier for these non-experts to easily understand and express their ideas by mapping the algorithmic feature to a concept they are familiar with.

Third, we found that using metaphors in our PD helped our study participants to think outside of the basic frame of online dating algorithmic features. By comparing different concepts through metaphor, participants were inspired to imagine new algorithmic features that break away from the traditional online dating framework. This was important in our study context as the findings from study 1 indicated how participants tended to adapt to the algorithm system despite the challenges they experienced, using strategies to achieve higher attractiveness scores, or blaming others instead of critically viewing the system. For example, while study 1 participants explained an adaptation to the algorithms’ scoring system by selecting one out of 100 photos, and even considering cosmetic surgery for higher scores, participants from study 2 provided algorithmic

features that go against them such as a system where users can convey their combined preferred values to the algorithm system, or prioritizing the match of other values like individual flaws. Leveraging these characteristics of metaphors and the findings from our study, we highlight how PD research on future technology (e.g. algorithms, AI, metaverse, etc) dealing with sensitive or emotionally complex situations could aid from using metaphoric design approaches.

7.5 Design Implications

7.5.1 Adaptive and Personalized Matchmaking. As noted in section 7.1 and 7.2, algorithmic matchmaking features which fail to incorporate diverse individual values challenged many users as inducing them to focus on the values prioritized by the algorithmic beliefs on attractiveness scores. The South Korean online dating market is witnessing an evolution with the emergence of diverse applications, each emphasizing different user values. For example, South Korean online apps, Amanda⁸ championing a selective approach based on physical attractiveness, contrasts sharply with 2ulip⁹, which prioritizes personality traits and individual thoughts. The latter app, notably, ask specific questions via user preferences and personalities, while removing profile images. These developments signify a growing recognition among application designers of the need to accommodate a broader spectrum of matchmaking values, extending beyond mere physical appearances.

Our findings suggest a gap between current offerings and user desires. We found that online daters seek platforms that do not just emphasize a singular value system but rather exhibit the flexibility to adapt to their changing preferences and matchmaking styles. Therefore, we propose a system design that dynamically adjusts to the fluctuating preferences and states of users. For instance, a user's priorities may vary; at times, physical attractiveness might be paramount, while at other times, a deep connection based on shared experiences and vulnerabilities might be sought. This necessitates an algorithmic approach that can accommodate such variability in user preferences [83].

7.5.2 Integrating Real-Life Dating Strategies into Digital Dating. Our findings from section 7.2 imply how online daters experience challenges of 'endless loop of evaluation', or 'user objectification' due to the uniform style matchmaking across all users. While many participants suggested diverse algorithmic features relating to diversifying matchmaking, we found a collective user desire to incorporate their real-life dating strategies into online platforms. In real-world scenarios, individuals adopt diverse approaches tailored to the unique preferences and personalities of potential partners [8]. These strategies, varying in effort and style, reflect a dynamic and nuanced understanding of interpersonal interactions, which is often lacking in the rigid frameworks of current online dating algorithms. Our findings revealed that these strategies were desired to be used in online dating as well, as they designed features such as a system where they can tailor their dating profile depending on the standards of others, like tailoring a resume for applying for a company.

To seamlessly blend these user-centric, real-life dating methods into the digital sphere, we envision an algorithm that functions akin to an intuitive matchmaker. This advanced system would actively learn from a user's interactions and preferences, evolving over time to offer customized suggestions. For example, it could analyze communication patterns to propose engaging conversation starters or highlight shared interests, thereby fostering more meaningful exchanges. Additionally, it could intelligently recommend profile modifications, such as emphasizing particular hobbies or traits, to align more closely with the interests of a potential match. Take, for instance, a user with a passion for hiking interacting with someone who appreciates outdoor activities. The system could automatically bring forward their nature-related experiences or interests in their profile, ensuring

⁸<http://amanda.co.kr/>

⁹<https://www.2ulip.com/>

an authentic and relatable presentation. This adaptive strategy, reminiscent of the nuanced and personalized nature of real-world dating, not only enriches the user experience through greater autonomy and individualization but also transcends the generic approach of existing online dating algorithms. Such a platform, dynamically attuning itself to each user's unique profile and interaction style, paves the way for deeper, more authentic connections, echoing the fluidity and complexity of human relationships, a concept underscored by Hobbs et al. [44].

7.5.3 Online Dating Algorithms as Tool for Self-Improvement. As discussed in our findings 4.2, we found a collective user desire to track their changes in attractiveness scores to define their values which include not only the overall attractiveness of their visual appearances, but particular fashion styles, personality traits, and even communication styles. Moreover, our findings from 6.3 indicate that users desire an active interaction with the algorithms, supporting them with encouragement and positive feedback.

Online dating applications collect vast amounts of data, including users' preference data, behavioral data, and location data, to optimize algorithmic matchmaking [43, 74, 95]. Based on our study findings, we propose an enhanced algorithmic approach that leverages this data not only for matchmaking but also as a tool to help users find and improve their unique and diverse values. This can provide insights into the areas where users can discover parts of themselves that others find attractive but the users themselves were unaware of. For instance, if the online dating algorithm identifies that the user's trendy and hip style and fashion sense are the strengths, it could suggest ways to highlight these aspects in my profile. Also, if the algorithm identifies gaps in my hobbies or music tastes that are popular among those the user is interested in, it can offer ideas to improve their self-presentations. Furthermore, by using these personal strengths and space for improvement, the algorithm could provide encouragement during low matchmaking periods. Helping users discover their own attractiveness, supported with algorithmic encouragement during unsatisfying matchmaking periods would mitigate harm to the user's emotions and self-esteem. Thus, this perspective of promoting a focus on personal development rather than external validation can help mitigate the negative impacts on self-esteem commonly associated with online dating [5, 45, 91].

Here, we suggest broader implications of our design suggestions which could potentially take role in breaking down the social norms of lookism. Our design implications focus mostly on personal enhancement, which could raise concerns on how it could unintentionally reinforce lookism as the 'discovering and improving their own charms' could entail promoting the societal standards or pressure placed on dating website users. However, we highlight that our research proposes a rather transformative approach by exploring diverse ways to discover and use multidimensional aspects of individuals, challenging the current online dating industry merely focused on physical attractiveness as a whole [26, 39, 94]. By promoting a more holistic representation of individual attributes(e.g. Unique physical features, fashion style, mood, personal vulnerabilities, etc), we believe online dating platforms can tackle the current societal standards or pressure of lookism, and contribute to a more inclusive and equitable social paradigm.

7.5.4 Balancing goals between diverse stakeholders of the online dating services. Our design implications initially stem from our study findings on the users' adaptive strategies and desires for an improved algorithmic matchmaking experience. However, the online dating services do not exist to infinitely support relationship formation of their users, as the services involve diverse stakeholders including not only consumers, but advertisers, and the platform operator (the company). In the platform operators' perspectives, supporting users romantic relationships is a part of the service, but another core goal of these platforms are gaining profit. While there exists several strategies the companies use for gaining profit, one of them is the fast-paced visual oriented algorithmic matchmaking, as they keep users addicted and engaged for longer periods with the services [3].

Furthermore, as users become more invested in the app, they may be more willing to pay for premium features that enhance their experience [37], or experience a sense of urgency and FOMO (fear of missing out), also prompting users to make in-app purchases [38, 47]. Despite such benefits, it is still important for platform designers to balance these features with the desires of online daters. While engaging users for longer periods within the applications may seem beneficial in the short term, they eventually lead the consumers to leave the services in the long term due to burnout and application fatigue [67]. Such events are also found in our finding from Section 4.3, where participants replied to experience a reality hit after constant interaction with online dating algorithms, eventually repeating a behavior cycle of application installation and delete.

8 LIMITATIONS AND FUTURE WORKS

We acknowledge several limitations of the current study. First, our research was done with online dating application users in South Korea. Therefore, the unique characteristics from their cultural background could have amplified the results from our study. While it is worth observing radical user interactions at the extreme of a spectrum of applications, future works on dating algorithms with people from diverse cultural backgrounds could be done and compared with the results with this study. Moreover, we mainly used self-reported data from our participants, not their observed behavioral data. A mixed-method approach integrating an ethnographic study observing the behavior of users could provide more candid contents to investigate the unprocessed thoughts and emotions of our participants.

9 CONCLUSION

This research investigated the interplay between users and matchmaking algorithms in online dating platforms, employing a mixed-methods approach of interviews and a metaphoric co-design workshop. Findings reveal a complex user relationship with users and the evaluative features of these algorithms: users become the algorithms themselves and use the system for evaluations, leverage the algorithm to discover self values, and employ extreme self-presentation strategies for higher attractiveness scores. The co-design workshop using a metaphoric design approach highlighted a user desire for algorithms that prioritize personal values, automatically tailors matches, and support for personal growth. These insights suggest a need for algorithms to evolve beyond simple matchmaking to fostering deeper, meaningful connections. In summary, our study enriches the discourse on human-algorithm interaction in online dating, advocating for algorithmic refinements that resonate more deeply with achieving romantic relationships.

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A APPENDIX

A.1 Object cards

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<p>Tree</p> <ul style="list-style-type: none"> Through photosynthesis, carbon dioxide from the atmosphere is absorbed and oxygen is produced It helps to maintain ecosystems by providing habitat and food for various creatures 	<p>Snow</p> <ul style="list-style-type: none"> It's made of small ice crystals formed by condensation of moisture in the atmosphere Can provide both a pleasant experience and a risk/natural disaster 	<p>Pan balance</p> <ul style="list-style-type: none"> The weight is measured by placing objects on each arms, using weight balance It is used to symbolize fairness, justice, and balance 	<p>Gatekeeper</p> <ul style="list-style-type: none"> They maintain safe conditions and detect hazards They interact in a friendly and professional manner 	<p>Lunch Box</p> <ul style="list-style-type: none"> It is designed so people can easily carry it around People can enjoy a combination of different kinds of small dishes
				
<p>Palette</p> <ul style="list-style-type: none"> By combining various colors, people can express desired hues, tones and create color harmony It can be used to express emotions, mood, ideas, etc. 	<p>Drum</p> <ul style="list-style-type: none"> It leads and supports the beat and flow of the song People make noise by hitting it with hands or a stick 	<p>Rainbow</p> <ul style="list-style-type: none"> It appears in the sky after it rains Shines with seven lights 	<p>Dolphin</p> <ul style="list-style-type: none"> They make various sounds to communicate, share information within the group, or assist with their hunting They hunt in the water and utilize their high intelligence 	<p>Moon</p> <ul style="list-style-type: none"> The gravity of Earth keeps the orbit, supporting like a satellite The appearance of it changes in time
				
<p>Umbrella</p> <ul style="list-style-type: none"> It acts as a shelter to block rain and snow Depending on the weather, it can be useful or become a burden 	<p>Flag</p> <ul style="list-style-type: none"> When the wind blows, it flutters depending on the direction of the wind It can be used to mean conquest or control over a specific area 	<p>Designer bag</p> <ul style="list-style-type: none"> It becomes a means of indirectly expressing my wealth It is desirable and an eye catcher 	<p>Alarms clocks</p> <ul style="list-style-type: none"> People can adjust the time for notifications for my schedule When we set time for alarm, it makes a loud noise to notify me 	<p>High heels</p> <ul style="list-style-type: none"> It can add style and elegance It is uncomfortable to wear for a long time
				
<p>Cat</p> <ul style="list-style-type: none"> They are sensitive to environmental changes and need their owner When the attachment relationship is well formed, the cat follows its owner well 	<p>Airplane</p> <ul style="list-style-type: none"> It is a common transportation for long-distance traveling Seating classes are divided into business, economy, etc. 	<p>Subway</p> <ul style="list-style-type: none"> It alleviates traffic congestion in the city There are various routes and people can transfer 	<p>Island</p> <ul style="list-style-type: none"> It is surrounded by the sea It is used as a travel attraction that offers natural beauty and relaxation 	<p>Magnet</p> <ul style="list-style-type: none"> Different poles attract each other, while the same poles repel each other It is used to separate or select substances
				
<p>Egg</p> <ul style="list-style-type: none"> It has both properties of liquid and solid, changing from liquid to solid when heated It is used in various dishes 	<p>Whiskey</p> <ul style="list-style-type: none"> It has a variety of flavors and aromas depending on the grain used and aging process Moderate consumption improves mood, but excessive consumption is harmful to health 	<p>Honeybee</p> <ul style="list-style-type: none"> They play an important role in the pollination of flowers by transporting pollen They have a complex social system divided into queen bees, workers, and female drones each performing their roles 	<p>Butterfly</p> <ul style="list-style-type: none"> They go through metamorphosis and transform from caterpillars to butterflies They have wings of various colors and patterns and has a beautiful appearance 	<p>Chameleon</p> <ul style="list-style-type: none"> They change skin color depending on the environment to conceal oneself or convey signals One eye moves independently and looks in different directions simultaneously
				
<p>Camera</p> <ul style="list-style-type: none"> It captures and records visual images through optical lenses People can adjust image settings such as shutter speed and aperture size for desiring effects 	<p>Tooth</p> <ul style="list-style-type: none"> Baby teeth fall out at a certain age and new teeth grow in their place When people bite cavity, it causes pain and needs to be extracted and treated 	<p>Key</p> <ul style="list-style-type: none"> It is the only device that opens locks There is only one lock that matches each other 	<p>Poop</p> <ul style="list-style-type: none"> When food is digested, it is excreted from our body It is an inevitable natural physiological phenomenon 	<p>Needleleaf tree</p> <ul style="list-style-type: none"> Keeps green leaves for all 4 seasons The leaves are designed to endure snow and rain